

INITIAL SHAPE DETERMINATION OF LARGELY DEFORMED ELASTIC MEMBRANE

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Elastic membranes are widely used in various fields and their equilibrium state are attained by the large deformation. The shape designs of such structures with consideration of geometrical nonlinearity are difficult tasks. In this work, an initial shape determination, in which the initial shape is solved from the prescribed deformed shape under the given boundary condition, is formulated in membrane structures.

The author proposed a formulation of the initial shape determination for hyperelasticity and its numerical procedure[1], which is based on an arbitrary Lagrangian-Eulerian (ALE) finite element method[2]. In this paper, it is applied to the problem of membrane structures.

In contrast to the initial shape determination for hyperelasticity presented in our previous paper, the initial shape corresponding to the prescribed deformed shape in the membrane structure is not unique. To solve such an ill-posed problem, a regularized formulation to limit the desirable initial shape is proposed in this work. In the present formulation, an objective function to specify the desirable shape is introduced, and the equilibrium equation is considered as a constraint condition. Then the Lagrange multiplier method is employed to minimize the objective function subjected to the constraint condition.

References

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